Hacker
Brushless Motors

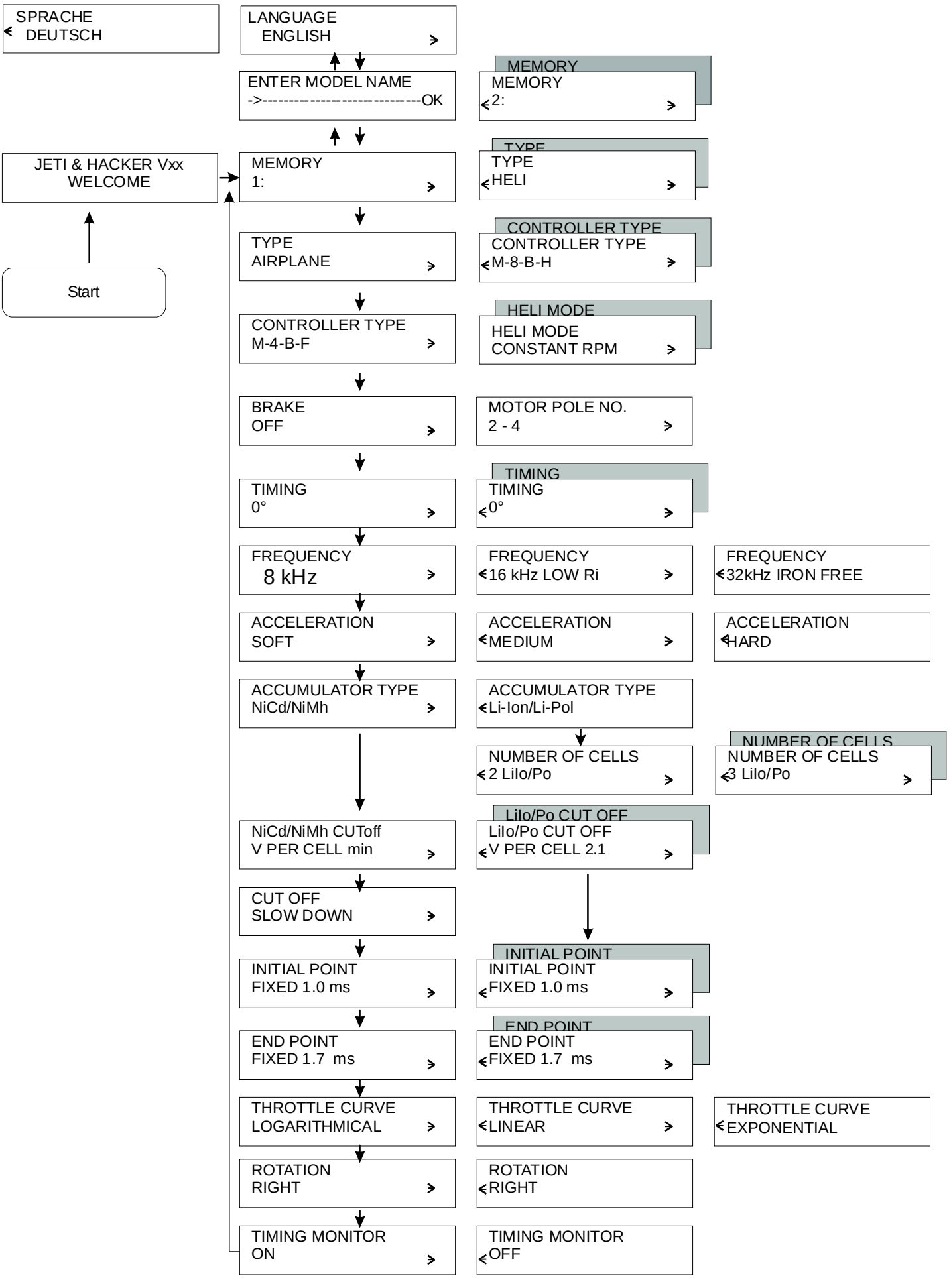
User Guide

Master Prog-Box

for programming

the new MASTER Controllers

MASTER Prog-Box programming sequence



Menu Item		Parameter		Explanation
Brake		Off		Brake activation and brake intensity
		Extra Soft		
		Soft		
		Medium		
		Hard		
		Extra Hard		
Heli Mode		Normal / Constant RPM		RPM governor activation for Heli controllers
Motor Pole No.		2-4, 6-10, 12-14		Adaptation of the controlling algorithm to the motor type or number of poles (Heli controllers)
Reverse		On / Off		Selection: Forward/Brake — Forwards/Brake/Backwards (RC Car controllers)
Current Limit		No Limit		Activation and setting of current limits for RC Car controllers. Enables maximum current limitation. No effect on brake settings!
		20,30...100A	20,40,60	
Timing		0°, 1°,2°...30°	2°, 8°, 15° 30°	Timing settings (advance) may be adjusted to suit the motor type. 2 Pole: 0...7° 4 Pole: 5...15° 8 Pole: 10...20° 10 Pole and higher (outrunners like LRK): minimally 20°
Frequency		8, 16, 32 kHz		Enables setting the frequency to suit the motor type. 8 kHz: universally recommended, lowest efficiency losses in the controller 16 kHz: recommended for low resistance/impedance motors 32 kHz: only recommended for motors with low inductivity
Acceleration		Soft / Medium / Hard		"Delayed" throttle response
Accumulator Type		NiCd/NiMh - Li-Ion/Li-Pol		Battery type selection
NiCd/NiMh	NiCd/NiMh Cut Off	min., 0.4, 0.5, ..., 1.0 V/Cell		Enables setting the voltage per cell for the point at which the controller's cut off circuitry engages.
Li-Ion/ Li-Pol	Li-Ion/Li-Pol – Number of Cells	LiIo/Po AUTO		Activates the automatic recognition of the number of cells for Li-Ion/Li-Polymer batteries. Only for 2 and 3 cell battery packs.
		2,3 LiIo/Po		Manual selection of the number of cells
		2,3,4,5 LiIo/Po		
		3,4,5, 6 LiIo/Po		
		4,5,6...10 LiIo/Po		
		3,4,5...10 LiIo/Po		
	Li-Ion/Li-Pol Cut Off	2.0, 2.1, 2.2 ....3.2 V/Cell		Enables setting the voltage per cell for the point at which the controller's cut off circuitry engages. 3.0V/cell recommended!
Cut Off		Slow Down / Hard		Allows setting the low voltage cut off type. The hard setting is highly recommended if the brake is disabled (typical for non-sailplane models).
Initial Fixed Point		Automatic		Automatic recognition of the motor off throttle setting. The transmitter's throttle lever should be fully off. The trim should be set in the middle.
		Fixed 1,0...1,5 ms		Fixed setting for the throttle off point.
End Point		Automatic		Automatic recognition of the full throttle motor setting. The transmitter's throttle lever should be fully on. The trim should be set in the middle.
		Fest 1,7...2,0 ms		Fixed setting for the full throttle point.
Throttle Curve		Logarithmical		Enables setting the throttle curve independently of transmitter programming.
		Linear		
		Exponential		
ABS		On / Off		ABS for brake functions (RC Car controllers)
Power Limit		Forwards: OFF, 75%, 50%, 25%		RPM limiting for RC Car controllers
Power Limit		Backwards: OFF, 75%, 50%, 25%		RPM limiting for RC Car controllers
Delay		0.25, 0.5, 0.75, 1, 1.5, 2, 5s		Delay between motor stop and reverse for Navy and RC Car controllers
Forward Point		Automatic		Automatic recognition of the throttle lever position for forward motion
		Fixed 1,0...1,3ms		Fixed setting for the forward point
Reverse/Brake Point		Automatic		Automatic recognition of the throttle lever position at which the brake/reverse is activated
		Fixed 1,0...1,3ms		Fixed setting for the reverse/brake point
Rotation		Left / Right		Motor rotation reversal via the controller's software
Timing Monitor		On		Activation of the timing monitor
		Off		

Menu Item		Parameter		M-4-B-Flight	M-8-B-Flight	M-18-B-Flight	M-30-B-Flight	M-40-B-Flight	M-40-O-Flight	M-70-B-Flight	M-70-O-Flight	M-125-O-F5F	M-135-O-F5B	M-195-O-F5B	M-90-O-F5D	M--48-O-Flight	M-77-O-Flight	M-90-O-ACRO	M-8-B-Heli	M-40-B-Heli	M-40-O-Heli	M-48-O-Heli	M-77-O-Heli	M-40-B-Navy	M-70-B-Navy	M-70-O-Navy	M-77-O-Navy	M-99-O-Navy	M-B-CAR-MINI	M-B-CAR-RACE	M-B-CAR-COMPET.
Brake		Off		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
		Extra Soft		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
		Soft		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
		Medium		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
		Hard		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
		Extra Hard		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x													
Heli Mode		Normal / Constant RPM																	x	x	x	x	x								
Motor Pole No.		2-4, 6-10, 12-14																	x	x	x	x	x								
Reverse		On / Off																						x	x	x	x	x	x	x	x
Current Limit		No Limit																												x	x
		20,30...100A	20,40,60																											x	x
Timing		0°, 1°,2°...30°	2°, 8°, 15° 30°	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Frequency		8, 16, 32 kHz						x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x		x	x
Acceleration		Soft / Medium / Hard		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Accumulator Type		NiCd/NiMh - Li-Ion/Li-Pol		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
NiCd/NiMh	NiCd/NiMh Cut Off	min., 0.4, 0.5, ..., 1.0 V/Cell		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Li-Ion/ Li-Pol	Li-Ion/Li-Pol - Number of Cells	LiIo/Po AUTO		x	x	x	x	x		x									x	x				x	x				x	x	x
		2,3 LiIo/Po		x	x	x	x	x		x									x	x				x	x				x	x	x
		2,3,4,5 LiIo/Po							x		x	x			x						x					x					
		3,4,5, 6 LiIo/Po												x																	
		4,5,6...10 LiIo/Po																				x	x								
		3,4,5...10 LiIo/Po											x			x	x	x									x	x			
	Li-Ion/Li-Po Cut Off	2.0, 2.1, 2.2 ....3.2 V/Cell		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Cut Off		Slow Down	Hard	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						x	x	x	x	x	x	x	x
Initial Fixed Point		Automatic		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
		Fixed 1,0...1,5 ms		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
End Point		Automatic		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Fixed 1,7...2,0 ms		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
Throttle Curve		Logarithmical		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Linear		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Exponential		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ABS		On / Off																						x	x	x	x	x	x	x	x
Power Limit		Forwards: OFF, 75%, 50%, 25%																						x	x	x	x	x	x	x	x
Power Limit		Reverse: OFF, 75%, 50%, 25%																						x	x	x	x	x	x	x	x
Delay		0.25, 0.5, 0.75, 1, 1.5, 2, 5s																						x	x	x	x	x	x	x	x
Forward Point		Automatic																						x	x	x	x	x			
		Fixed 1.7, 1.8, 1.9, 2.0ms																						x	x	x	x	x			
Rev./Brake Point		Automatic																											x	x	x
		Fixed 1,0, 1.1, 1.2, 1.3ms																											x	x	x
Rotation		Left / Right		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x								
Timing Monitor		On		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
		Off		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Menu Item		Parameter		M-4-B-Flight	M-8-B-Flight	M-18-B-Flight	M-30-B-Flight	M-40-B-Flight	M-40-O-Flight	M-70-B-Flight	M-70-O-Flight	M-125-O-F5F	M-135-O-F5B	M-195-O-F5B	M-90-O-F5D	M--48-O-Flight	M-77-O-Flight	M-90-O-ACRO	M-8-B-Heli	M-40-B-Heli	M-40-O-Heli	M-48-O-Heli	M-77-O-Heli	M-40-B-Navy	M-70-B-Navy	M-70-O-Navy	M-77-O-Navy	M-99-O-Navy	M-B-CAR-MINI	M-B-CAR-RACE	M-B-CAR-COMPET.

The fields with a gray background indicate the default settings and are programmable by use of a transmitter.

Thank you for purchasing a Hacker Brushless Motors product. The *MASTER* Prog-Box was developed in close cooperation with JETI and incorporates the latest technological developments. Hacker *MASTER* brushless, sensorless motor controllers are designed with particular emphasis on reliability and easy, transmitter-based programming of most parameters. The Prog-Box additionally leverages the greatly expanded programming capabilities of these new controllers by allowing individual adjustment of virtually all parameters.

Although the programming sequences of the *MASTER* Controllers are particularly logical and therefore quite simple, programming via the *MASTER* Prog-Box requires a little knowledge and a few basic skills. Reading this user guide attentively prior to initial operation will enable you to familiarize yourself with the concepts of this device enabling quick and sure programming. Please pay particularly close attention to the safety tips.

We wish you much joy and success with your *MASTER* series products.

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1. Safety and operating instructions

Building and operating remotely controlled models requires a high level of technical competence, careful handling and a particular emphasis on safety. Inaccurate and faulty construction as well as inattentive and careless operation can result in significant property and/or personal injuries. Consequently, particular emphasis should be placed on working carefully and on the prudent operation of our controllers.

The CE mark guarantees the conformance with the applicable laws ensuring trouble free operation; it does not however entitle you to careless handling of the controller. The *MASTER* product series was developed exclusively for use in radio controlled models. The controller may not be under any circumstances be used in man-carrying aircraft, man-carrying vehicles or the like.

The *MASTER Prog-Box* is designed for use with batteries only. Do not use the *Prog-Box* with a power supply, incorrect voltages can destroy it. Never connect the *Prog-Box* to alternating current (typically 100-230 V).

Remove the propeller or other rotating objects prior to programming the controller. Be sure to remove other objects that may be able to come into contact with the rotating parts of the motor assembly. Mechanical or electrical defects may lead to sudden, unexpected starting of the motor. Please be sure to protect yourself from the danger that may result in particular from rotating propellers or rotor blades.

The *Prog-Box* should be protected against the effects of vibration, dust, moisture, shock or pressure. Inspect the *Prog-Box* for damage at regular intervals. Should the device have been exposed to moisture it should not be used again until it has been thoroughly dried and closely inspected? The Prog-Box should not be used if it has been damaged and must be sent to our service department for repair should you wish to use it in the future.

No modifications or alternations of any type may be made to the *Prog-Box.*

Use the device only in ambient temperatures between –10°C/+14°F and +50°C/+122°F. The *Prog-Box* may only be used in an environment free of static electricity.

The *Prog-Box* is not protected against reversed polarity, reversing the connecting leads will cause it to be damaged or destroyed.

Should a BEC be used as the power source for the *Prog-Box,* a receiver battery may not be connected in parallel. Doing so will inevitably result in the destruction of the BEC circuitry. If it is desirable to use a controller with BEC in conjunction with receiver battery, then the red (+) connecting lead must be removed from the receiver connector of the *MASTER* controller. When using the UNI connectors employed by the MASTER series, a small screwdriver may be used to loosen the retaining mechanism and to then to push the lead out of the connector. The loose end must be carefully insulated. Once the BEC is inoperative a receiver battery may be connected without danger.

Connect the throttle servo cable of the controller to the corresponding connection on the *Prog-Box.*

The MASTER Controllers are pre-set for optimal use with Hackler Brushless Motors on delivery. The motor brake is activated for fixed wing models. Please refer to this user guide for the appropriate settings for other motors.

2. Limitation of liability

As Hacker Motor GmbH has no ability to ascertain whether our controllers are installed and used in conformance with our recommendations, and as we can not verify how our controllers were maintained, Hacker Motor GmbH can not assume any liability for losses, damages or costs arising from their use. Any and all claims arising from the use, failure, or malfunction of our products, or in any way arising in conjunction therewith, will be refused. Hacker Motor GmbH assumes no liability for personal injury, property damage or consequential damages arising resulting from the use of our products or arising from our workmanship. To the maximum legally permissible extent, liability claims arising for any reason will be limited to the selling price of the Hacker Motors GmbH product involved. Exceptions will only be made as required by legislation or if gross negligence on the part of Hacker Motor GmbH results in the exclusion of the limitation of liability.

3. Product description

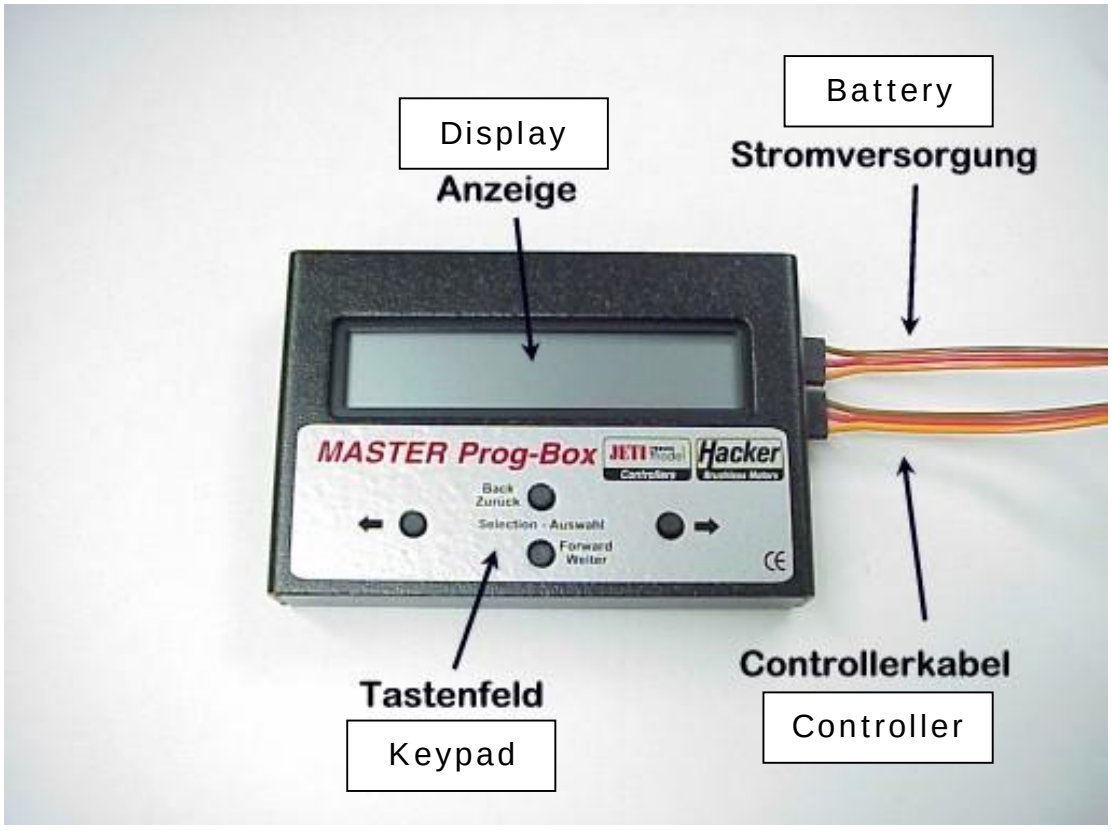
MASTER controllers contain highly sophisticated circuitry and were specifically designed for the use with Hacker brushless motors. Their flexible and effortless programmability combined with support for different operating modes additionally makes them ideal for use with other brushless motors. Compact dimensions enable these controllers to fit into the smallest models.

All *Master controllers* may be programmed by using a transmitter or by using a *MASTER Prog-Box*. While the programming capabilities available via transmitter are identical to those provided by our previous *MASTER* controllers, the *MASTER Prog-Box* enables the entire range of programming functionality to be accessed.
All settings must only be programmed once. The controller saves the configuration settings until they are overwritten by the next programming sequence. This holds true even if the power source is disconnected.

An overview of all programming possibilities may be found in Annex A-3 and A-4.

4. Connections and controls

Please refer to the graphic below for overview of the connections and controls:



5. Initial operation of the *MASTER Prog-Box*

The *MASTER Prog-Box* requires a power source for operation. A BEC controller or a receiver battery may be connected for this purpose per the above diagram. Please be sure to observe the proper polarity and ensure that the voltage is between 4.5V and 6.0V.
The motor is used as a loudspeaker to confirm *MASTER Prog-Box* programming sequences. It is essential that the motor be properly mounted according to its directions and that the controller is correctly connected prior to beginning with programming.

Remove the propeller or other rotating objects prior to programming the controller. Be sure to remove any and all objects that may be able to come into contact with the rotating parts of the motor assembly. As mechanical or electrical defects may lead to sudden, unexpected starting of the motor please be sure to protect yourself from the danger that may result. In particular that posed by rotating propellers or rotor blades.

Ensure that the controller cable is securely and correctly connected to the *MASTER Prog-Box*. It is advisable to carefully check all connections to prevent malfunctions that may lead to damage or destruction of the controller.

Finally, connect the motor's battery to the proper connectors on the controller. This connection is required for the motor to provide acoustical confirmation of the programming sequences as described above.

6. Programming *MASTER* controllers using the *Prog-Box*

6.1 Operating principles

Since the programming of the many different models of Hacker brushless controllers is essentially identical, the individual programming steps described apply to all our controllers.

Please pay close attention to the programming sequences in Annex A-5

Ensure that the motor battery, or for controllers without BEC, the receiver battery, has sufficient capacity for the programming to be completed. All changes to parameters or settings are acoustically confirmed by the motor, the controller immediately saves the new settings. Multiple parameters may be changed during each programming session and the parameters may be changed as often as desired.

Please study the programming capabilities in Annex A-3 carefully

7. Warranty

Every MASTER Prog-Box undergoes numerous tests during production and we place particular emphasis on ensuring that our products are of the highest possible quality. Hacker Motors GmbH products are covered by a 24-month warranty. The warranty is limited to a free-of-charge repair provided proof of a material failure can be established. We reserve the right to replace a device if an economically feasible repair is not possible.

Proof of warranty may be provided by the receipt or invoice issued in conjunction with the purchase of the product. In the event of a repair, the warranty will not be extended. Incorrect use or operation arising for example from incorrect polarity, excessive voltage or moisture will result in the denial of a warranty claim. Defects arising from wear and tear or vibration will also be treated in the same manner. Any other claims, consequential damages for example, are explicitly precluded. Also excluded are any and all liabilities for damages arising from the device itself or use thereof.

All products returned for repair must be sent free-of-charge to Hacker Motor GmbH, parcels sent with postage or other fees due cannot be accepted. We can not assume responsibility or liability for damages or losses occurring in shipping.

Warranty claims will be honored provided that the following conditions are met:

- The invoice or receipt for the product to be repaired is included
- The product was used in accordance with this user guide
- The product was used with the recommended voltages and currents
- A clear description of the problem or defect is included

8. Declaration of conformity

The described products are in compliance with the relevant and applicable EC guidelines for electromagnetic compatibility:

89/336/EWG
92/31/EWG
93/68/EWG